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PRELIMINARY REPORT
AN EVALUATION OF POTENTIAL WATER POLLUTION PROBLEMS FROM SUBDIVISIONS IN THE STATEWIDE 208 STUDY AREA

Prepared by:

Subdivision Bureau
Montana State Department of Health
and Environmental Sciences

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PREFACE

We are pleased to submit this appraisal of the possible effects of subdivisions on water quality in the non-designated statewide 208 study area.

This investigation was funded under Section 208 of the Federal Water Pollution Control Act Amendments of 1972 (P.L. 92-500). The project which was contracted to the Subdivision Bureau was in the total amount of $6,601.74 and conducted between July 1 and October 1 of 1977. Mr. Gerald C. Brown, a graduate student at the University of Montana, provided much of the field study and review in developing this project report.

During the process of this investigation we have received most of our data from county sanitarians. These professionals have provided outstanding support and cooperation. By last name and county they are: Regan (Beaverhead); Herndon (Blaine and Hill); Gillin (Broadwater and Jefferson); Kalafat, Stevenson, Frazier, Furan, and Wanke (Cascade); Geach (Dawson, Garfield, McCone and Prairie); Strasko (Deer Lodge, Granite and Powell); Balster (Fergus); Selser, Cramer, Brawner and DeCou (Lewis & Clark); Schultz (Lincoln); Hedrick (Meagher, Park and Sweet Grass); Foy, Aldegarie, Zuleger, Becker, and Barger (Missoula); Altschwager (Pondera and Teton); Stahl and Jones (Ravalli); Marshall (Sanders); and Mclean (Silver Bow). Likewise, other county, state and federal agencies have provided considerable assistance.

A unified effort is needed to assure development of well planned subdivisions which do not threaten or impair water quality.

It is our opinion that this study is both necessary and timely, as Montana is currently experiencing considerable development. Since water is one of our most precious resources, we are both morally obligated and legally mandated to protect it for ourselves and future generations. Subdivision planning, review, and development must be viewed with this axiom in mind.

It is our hope that this investigation will be but an initial step in a comprehensive review of subdivisions as they may affect water quality in Montana.

INTRODUCTION

Between July 1, 1975 and June 30, 1976, 915 subdivisions were reviewed and approved by the Montana Department of Health and Environmental Sciences. (A subdivision is currently defined by Montana law as the division of land into one or more parcels containing less than 20 acres. Subdivisions are subject to review by the Montana Department of Health and Environmental Sciences (MDHES) for public health considerations if facilities requiring water supply and sewage disposal are proposed.)

Between July 1, 1976 and June 30, 1977, approximately 1500 Montana subdivisions were approved. It is projected that for fiscal years 1977-78 and 1978-79, approximately 2100 and 2600 subdivisions will be approved, respectively.

Subdivision development has become increasingly active in Montana as well as other western states. The current study was begun as an initial step in determining what effects, if any, subdivision development has on the quality of state waters in Montana. To date, no such study has been done. The investigation was based on existing subdivisions, which in most cases fell under the jurisdiction of subdivision laws and regulations at the time of their development.

The 42 counties which are in the Montana Statewide 208 study area are shown in Figure 1. Although much subdivision activity has taken place within the designated 208 areas (shaded), considerable development has occured in the non-designated counties. It is the non-designated counties which were studied for the

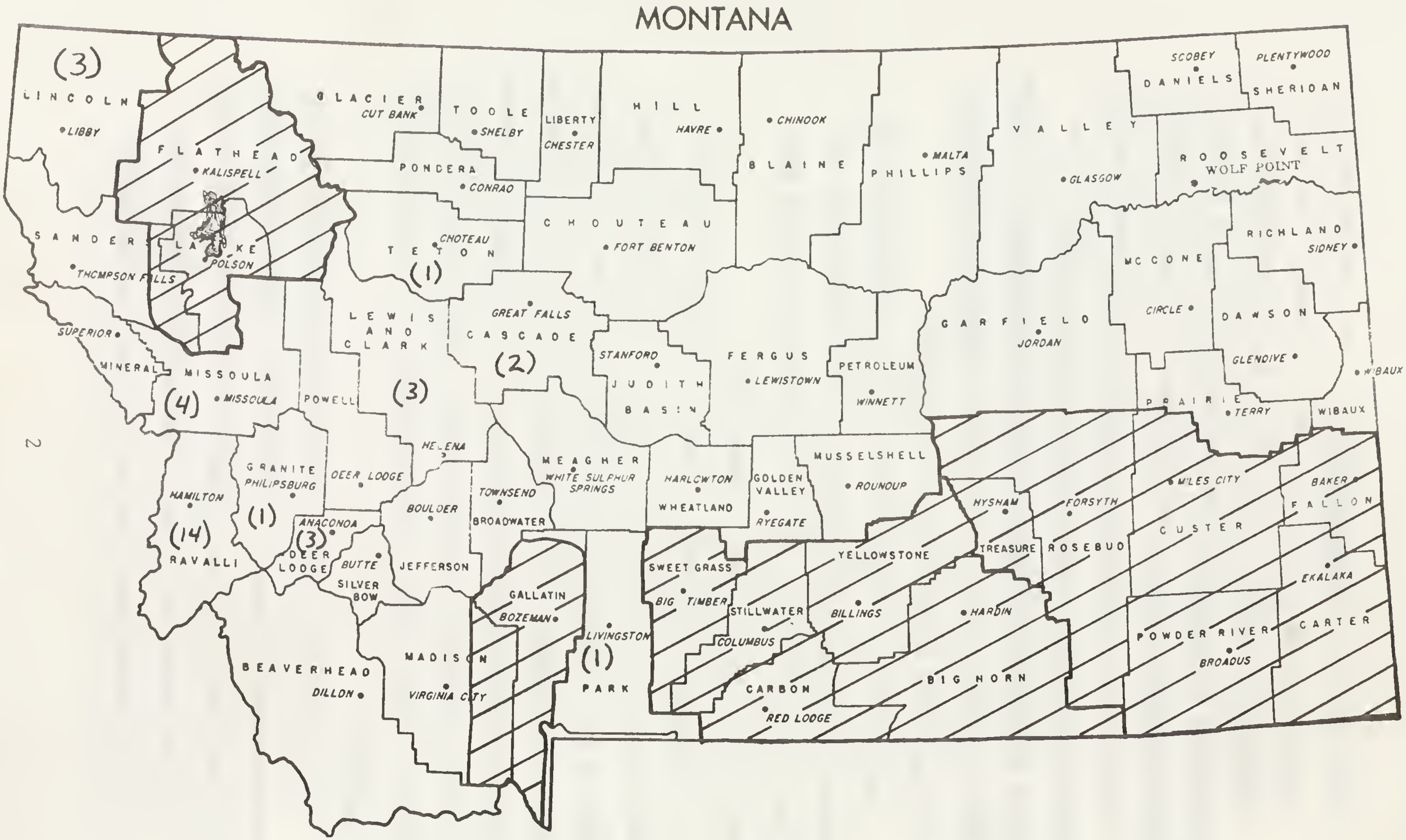

FIGURE 1. Distribution of the Thirty-Two Subdivisions Included in An Evaluation of Potential Water Pollution from Subdivisions in the Statewide 208 Study Area.

possible effects of subdivision activity on water quality in this investigation.

Figure 1 also shows the number of subdivisions studied in each county.

OBJECTIVES

With the assistance of local sanitarians, subdivisions were selected which do not conform with criteria currently mandated by Montana Laws and regulations and by policy of the MDHES. The subdivisions were selected with the following study objectives in mind:

1) To rank subdivisions in order of their potential for degradation of state waters.

2) To select several subdivisions for further study of their effects on water quality. Further study would include long-term investigation and collection of field data. The subdivisions were to be selected so that the results of further study would be helpful in evaluating similar subdivision areas in Montana. Results of a long-term investigation could prove very valuable to future subdivision planning, review, and development in Montana.

3) To make constructive recommendations for further action based upon the data collected in this study.

PROCEDURE

Collection of Data and Field Investigation

With the objectives in mind, local officials representing the 40 counties in the statewide 208 study area were contacted for an assessment of subdivisions which may have an adverse effect on water quality. Most of the counties had not experienced significant subdivision development and were not considered beyond the initial telephone contact.

Based on these contacts, on-site investigations, and an initial screening process, a total of 32 subdivisions were selected for intensive evaluation. Before the initial screening process, 58 subdivisions or development areas were specified by local sanitarians as having possible adverse effects on water quality. Fourteen of these areas were immediately eliminated because they were small communities rather than subdivisions and were being studied under another 208 project. The remaining 12 subdivisions were eliminated because local sanitarians had little or no field data to justify their consideration. The distribution of the final 32 subdivisions is shown in Figure 1. A list of the 32 subdivisions by county is shown in Table 1.

It should be noted here that some of the areas included in the study are not subdivisions per se. Some are groups of subdivisions; some are areas which were platted before subdivisions were defined in Montana; some were platted into large lots which exempted them from review as subdivisions; and one (Opportunity), is a small community. These areas were all included in the study because their investigation could prove beneficial to future study of similar areas which are subdivisions. For simplicity, all areas will hereafter be referred to as subdivisions.

Criteria Considered in Evaluation

Subdivisions suspected of having an adverse effect on water quality were evaluated and compared using mostly non-empirical data. The scope of the project simply did not permit collection of empirical data. Therefore, the data were collected for criteria which reflected pertinent information and which could be readily obtained. The criteria themselves were chosen to include those features of subdivision development which could lead to degradation of state waters.

TABLE 1. Subdivisions Included in an Evaluation of Potential Water Pollution Problems from Subdivision in the Statewide 208 Study Area.

SUBDIVISION	COUNTY
Park Garden Estates	Cascade
Woodland Estates	Cascade
Valley View	Deer Lodge
Sunset	Deer Lodge
Opportunity	Deer Lodge
Lakeview	Granite
Colorado Heights	Lewis & Clark
Lambkin's	Lewis & Clark
Sewells Addition #4	Lewis & Clark
South Libby Flats	Lincoln
West Libby	Lincoln
Yaak Meadows	Lincoln
Seely Lake Shoreline	Missoula
Clark Addition	Missoula
Eastbrook Addition	Missoula
Mallard Estates	Missoula
Five Acre Tracts	Park
H & R Addition	Ravalli
Bass Creek Development	Ravalli
Entropy Acres	Ravalli
Hawker Lame Estates	Ravalli
Bassard Development	Ravalli
Florentine Acres	Ravalli
Klements Road	Ravalli
Burnt Fork Tracts	Ravalli
Kootenai Creek Road	Ravalli
Dayton Addition	Ravalli
Rippling Woods	Ravalli
Wild Wood Park Ranchettes	Ravalli
Tie Chute Lane	Ravalli
Rickett's Road	Ravalli
Gibson Lake Tracts	Teton

The evaluation form utilized for data collection is shown in Appendix A. Data on these forms were obtained from county sanitarians, on-site observations, and by accumulating existing data from the MDHES, Montana Department of Community Affairs, the Soil Conservation Service, and from City-County Planning Organizations. Since the initial form was developed, other parameters were determined to be pertinent and were considered in the study. The forms themselves were not changed, but all data have been included on the forms.

Criteria used in the evaluation were:

1) Depth to groundwater
2) Percolation rates
3) Slope
4) Total number of lots
5) Present density
6) Wells
7) Sewage disposal system
8) Susceptibility to flooding
9) Age of the subdivision
10) Proximity to surface water
11) Ratio of groundwater flow to effluent flow
12) Development potential

It should be noted that soil types per se are not being utilized in the evaluation; percolation rates were chosen as a criterion instead. Percolation rates are a rough indicator of the amount of sewage treatment in the soil and can be more readily compared than soil types. Soils information is available on the completed evaluation forms in Appendix A.

Development of the Point System for Prioritization

After the data were gathered, weighted point values were assigned to each criterion. Point values vary depending upon the significance of the criteria (Table 2). For instance, the depth to groundwater criterion was assigned a total point value of fifteen while the subdivision age criterion was assigned a total value of five points. Within a given criterion, point values vary according to magnitude of the data (Table 2). As implied in the above discussion, point values increase as the potential adverse effects on water quality increase.

The point system was developed with the following considerations in mind:

i) Current laws and regulations

ii) Current research and technical publications

iii) Judgement of personnel involved with state level subdivision review or having relevent scientific backgrounds.

A discussion of the development of point assignments for each criterion follows.

1) Depth to Groundwater

Montana regulation MAC 16-2.14(10)-S14480 Water Quality Standards does not establish groundwater quality standards and does not even include groundwater as a state water. Montana's Laws Regarding Public Water Supply, Title 69, Chapter 50 R.C.M. 1947 (Section 69-4901 through 69-4908) and Montana's Laws Regarding Water Pollution, Title 69, Chapter 40 R.C.M. 1947 (Section 69-4801 through 69-4827) do include groundwater as a state water and address protection of domestic water supplies. Since groundwater is commonly used as a domestic water supply in subdivisions in conjunction with subsurface septic tank effluent disposal, pollution of groundwater is of concern for several reasons:

a) Protection of public health;

TABLE 2. Summary of Point Assignments to the Prioritization Criteria.

Evaluation Criteria	Total Value per Criteria	Severe Problem (Value/Criteria)	Moderate Problem (Value/Criteria)	Low or No Problem (Value/Criteria)
Depth to Groundwater	15	2 feet/15	2 - 6 feet/10	6-20 feet/5 - <20 feet/0
Percolation	10	1 or 120 min/in /10	5 - 60 min/in /5	5 - 60 min/in/0
Slope	5	25 percent/5	15 - 25%/3	15%/0
Total Number of Lots	10	50/10	30 - 50/6	10 - 30/3 - 10/0
Present Density (ac/unit)	10	½/10	½ - 1/7	1 - 5/5 - 5 - 20/2
Wells	8	Individual/8	Group/6	Central/3
Sewage Disposal System	5	Cesspool/5	Septic Tank–Pits/3	Septic tank-drainfield/1
Susceptibility to Flooding	5	high/5	moderate/3	low/1
Age of Subdivision	5	16 yrs/5	4 - 16 yrs/3	4 yrs/1
Proximity to Surface Water	6	100 ft/6	100 - 500 ft/4	500 ft/2
Ratio of Groundwater Flow to Effluent Flow	15	low/15	medium/10	high/5
Development Potential	10	high/10	moderate/5	low/0

b) Protection of hydrologic systems such as streams and springs; and

c) Compliance with state law.

Montana regulation ARM 16-2.14(10)-S14340 Subdivisions stipulates that a separation of four feet between the drainfield trench bottom and groundwater shall be allowed. Also, a minimum separation of six feet between the natural ground surface and groundwater is required.

With these considerations, the assumption is made that use of a subsurface sewage treatment system will have an adverse effect on water quality if groundwater is within six feet of the ground surface. Because depth to groundwater is of such importance, the maximum point value was assigned to this criterion.

Groundwater within two feet of the surface causes partial or complete inundation of the treatment system and permits only a minimum amount of treatment within the soil. The total value of fifteen points was assigned to subdivisions having groundwater present within two feet of the ground surface. Ten points were assigned where groundwater depths were between two and six feet and five points were assigned where depths were between six and twenty feet.

A minimum separation of twenty feet is required in ARM 16-2.14(10)-S14340 Subdivisions before a reduction in lot size requirements can be considered by the MDHES. A twenty foot separation is therefore considered generally adequate for treatment of sewage from septic systems. Consequently, no points were assigned if separation was greater than twenty feet.

2) Percolation Rates:

Soil percolation rates are roughly indicative of the amount of sewage treatment accomplished within the soil. A coarse textured soil generally provides less treatment of sewage than does a well graded or finer soil. A coarse textured soil allows less time for treatment of the sewage by soil microorganisms. Extremely fine soils are not practical for subsurface disposal because of very slow percolation rates.

At the time of this writing, the MDHES does not permit installation of conventional septic tank and drainfield systems where percolation rates exceed sixty minutes per inch. (Percolation tests are required to be conducted in accordance with the Manual of Septic Tank Practice, DHEW publication number (HSM) 72-10020). The MDHES also considers percolation rates less than five minutes per inch as undesirable in terms of the time available for microbiological treatment of sewage. However, rates less than five minutes per inch are permitted in subdivisions if groundwater separation appears adequate. It was assumed then that percolation rates between five and sixty minutes per inch are acceptable, but rates outside that range can adversely affect water quality.

Since percolation rates are indicative of soil types, they are a very important consideration for this study; this is reflected by an assigned total value of ten points. Percolation rates less than one minute per inch were assumed to allow essentially no time for microbiological treatment of sewage. It was also assumed that a soil with rates slower than one-hundred twenty minutes per inch would quickly seal and not permit infiltration of septic tank effluent.

This would cause surfacing of effluent, creating public health problems and potential for degradation of surface waters by overland flow. Percolation rates of less than one minute per inch and greater than one-hundred twenty minutes per inch were consequently assigned a value of ten points; rates between one and five minutes per inch and between sixty and one-hundred twenty minutes per inch were assigned a value of five points; and no points were assigned if percolation rates for a subdivision were between five and 60 minutes per inch.

3) Ground Slope:

Where subsurface disposal of effluent is utilized, ground slope is important for two reasons:

a) Excessive slopes with impervious layers such as heavy clay or bedrock may cause sewage effluent to surface down slope; overland flow may then lead to pollution of surface waters. This consideration is of particular interest to this study.

b) Slope failures may occur due to additional liquids entering the soil.

ARM 16-2.14(10)-S14340 Subdivisions requires the submission of additional soils and engineering data for drainfield installations in slopes greater than fifteen percent. Present policy prohibits installations in slopes greater than 25 percent. Where slopes exceed twenty-five percent, it is assumed that subsurface sewage disposal will probably lead to contamination of surface waters.

Ground slope was given a total value of five points. Slopes greater than 25 percent were assigned five points; slopes between fifteen and twenty-five percent were assigned three points; and slopes less than fifteen percent were assigned no points.

4,5) Total Number of Lots, Present Density:

Total number of lots and present density have a direct bearing on the amount of sewage effluent entering the soil at ultimate development and at present development. For instance, a large subdivision with small lots utilizing sewage disposal systems would have more potential for groundwater pollution than an identically sized subdivision with large lots, given a comparable physical setting. One important unknown is that existing lots may be further subdivided, thus increasing population density and subsurface sewage loadings. The MDHES currently prepares an assessment for all subdivisions larger than fifty lots. The assessment addresses environmental and public health concerns as well as social and economic questions.

If the total number of lots in the subdivision exceeded fifty, ten points were assigned to the criterion. Six points were assigned if the number of lots were between thirty-one and fifty; three points were assigned if the number of lots was between eleven and thirty; and no points were assigned for subdivisions having ten lots or less.

The point value for the present density criterion was based on the number of acres per dwelling unit. Present Montana subdivision regulations prohibit the installation of septic tank and drainfield systems on lots less than one-half acre in size if a public water supply system is utilized. If both individual water supply and sewage disposal systems are used, the minimum lot size permitted is one acre.

A subdivision with a predominance of units on one-half acre lots was assigned the total value of ten points. Seven points were assigned if lot sizes were between one-half and one acre; five points were assigned if lot sizes were between five and twenty acres. Presently, division of land into parcels larger than twenty acres are not subdivisions in Montana and consequently no points were assigned if the lots were larger than twenty acres.

6) Wells:

Wells drilled to serve individual homesites are normally shallower than wells serving public supplies. Therefore, individually drilled wells tend to have a greater susceptibility to contamination.

There are considerable differences among the types of domestic wells. A drilled, properly cased and sealed well is considered the safest water supply in terms of public health. Other forms of individual water supplies such as shallow wells, dug wells, sandpoint wells, springs, rivers, and lakes are inherently more susceptible to microbial and nitrate contamination.

A public water supply system is defined in ARM 16-2.14(10)-S14340 Subdivisions as one which serves ten or more families or twenty-five or more persons for at least sixty days out of the calendar year. A multiple family water supply system is defined as one which serves two to nine families and not more than 24 people. An individual water supply system is defined as one which is not a public or multiple family system.

The type of water supply system is of considerable importance and so, the well criterion received a total point value of eight.

points were assigned. Six points were assigned if a multiple family system was utilized and three points were assigned if domestic water was supplied by a public system. Information on the type of well and well depths is available in Appendix A.

7) Type of Sewage Disposal System:

A properly installed septic tank and drainfield system with adequate soils and adequate separation to groundwater is now considered by the MDHES as the best form of individual on-site sewage treatment. In older subdivisions, septic tanks with undersized drainfields, seepage pits, and even cesspools have been used for sewage treatment. Because cesspools provide no septic tank pretreatment of wastes, the total value of five points was assigned to subdivisions utilizing cesspools as the predominant method of treatment. Subdivisions utilizing seepage pits were assigned three points and subdivisions utilizing conventional septic tank and drainfield systems were assigned one point.

8) Susceptibility to Flooding:

Flood plain areas are susceptible to inundation from a one-hundred year flood and have been officially designated by the Montana Department of Natural Resources and Conservation. Flood prone areas are also susceptible to flooding from a one-hundred year flood but were designated by the United States Geological Survey.

Flooding can impair both surface and groundwater quality and may contaminate domestic wells in addition to temporarily halting operation of sewage disposal systems. Because flooding inundates the land surface, treatment capabilities of the soil are destroyed. Thus, contaminants such as microbes and nitrates are injected directly into ground and surface water.

Within the studied subdivisions, the designated floodplain and flood prone areas were located. Subdivisions located totally or partially within floodplain areas were assigned the total value of five points. Because flood prone designations are based on less research and investigation, subdivisions partially or totally in flood prone areas were assigned three points. Subdivisions not located in floodplain or flood prone areas were assigned no points.

9) Age of Subdivision:

Age of a subdivision is important because the regulations in effect when MDHES review was conducted dictated which lot sizes, type of sewage treatment facility and depth of well were approved. Between May, 1961, when MDHES's review of subdivisions began, and November, 1973, seepage pits were permitted as a form of sewage treatment. Also, minimum lot size requirement for individual water supply and sewage disposal systems was 20,000 square feet. Seepage pits are no longer permitted and minimum lot size has increased to one acre. Thus, a form of sewage treatment now considered inadequate and higher subsurface loading rates were permissable before November, 1973. Also, individual sewage disposal facilities have generally improved over the past fifteen years in terms of materials and installation practices.

Assignment of total point values for the age of a subdivision was based on the above mentioned dates. Subdivisions over sixteen years old received the maximum total of five points; those between four and sixteen years old received three points; and those less than four years old received one point.

10) Proximity to Surface Water:

Water quality of streams and lakes is protected by Montana regulation MAC 16-2.14(10)-S14480 Water Quality Standards. Springs are also protected where they are used as a domestic water supply. Therefore, the proximity of subdivisions to streams, springs, and irrigation ditches was noted in this review.

The presence of streams and springs may be an indication that groundwater could rise to unacceptable levels. Also, present subdivision regulations require a one-hundred foot separation between individual sewage treatment systems and streams and springs.

Subdivisions within one-hundred feet of a spring or stream were assigned six points; subdivisions within one-hundred to five-hundred feet were assigned four points; and two points were assigned if the separation was greater than five-hundred feet.

11) Ratio of Groundwater Flow to Effluent Flow:

Soils have been shown to be an excellent media for filtering microorganisms. However, in coarse textured soils and fractured bedrock, soil loses its filtration efficiency and microorganisms move through with more freedom. Nitrogen compounds are commonly present in sewage effluent in the form of nitrates, nitrites, and ammonia. Unfortunately, highly soluble nitrates tend to travel in the groundwater system relatively uninhibited. Concentrations of nitrates in domestic sewage typically range from twenty to forty milligrams per liter. The Federal Interim Primary Drinking Water Standards allow a maximum of ten milligrams per liter of nitrate-nitrogen in drinking water. Thus, without dilution, serious groundwater contamination problems can occur due to an excess concentration of nitrogen in domestic wastes.

Based on the subjective judgement of a hydrogeologist, the ratio of groundwater flow to effluent flow was categorized as low, medium, or high; criteria used were size and transmissability of the aquifer and size of the subdivision.

Because the aquifer ultimately receives wastes that have not been removed in the soil or used in evapotranspiration, this criterion was regarded as quite significant in the evaluation. Fifteen points were assigned to a subdivision with a low ratio of groundwater flow to effluent flow. Ten points were assigned for a medium ratio and five points were assigned for a high ratio.

12) Development Potential:

Subdivisions have varying degrees of potential for development depending on physical setting, trend in development, and economy of the area. Point assignment for this criterion were based on consultation with local officials and observations made during on-site visits. Because the potential for development has a direct bearing on the potential for pollution of state waters, 10 total points were assigned to this criterion. Subdivisions having a high potential for immediate, steady development received ten points. Areas which would develop sporadically but continually received 5 points; and, areas which appeared to have no further potential for development received no points.

RESULTS

Point values for each criterion and point totals for each subdivision are shown in Table 3.

Table 4 shows the final subdivision prioritization. Point totals ranged from 38 for Park Garden Estates in Cascade County to 80 for the South Libby Flats area in Lincoln County.

Four subdivisions received point totals between 70 and 80 points. Fourteen subdivisions were clustered between 60 and 69 total points; and, the remaining 14 subdivisions were scattered between 38 and 59 points.

DISCUSSION OF RESULTS

After prioritization was complete, subdivisions worthy of recommendation for further study were selected. Funding limitations would prohibit long-term investigation of a large number of subdivisions thus, only the top five subdivisions in the prioritization totals were selected. A discussion of the five areas selected follows:

1) South Libby Flats Area

This area is a series of adjacent subdivisions located south of Libby on Highway 2. We investigated five subdivisions in this area (White Have, Vicks Tracts, Pioneer, Wards and Granite) and grouped them into the South Libby Flats Area. Although South Libby Flats is fairly well developed with most of the 2,200 people living on ¼ and ½ acre lots, there is still considerable land available for further building and subdividing.

TABLE 3. CRITERIA POINT VALUES AND POINT TOTALS FOR EACH SUBDIVISION

	EVALUATION CRITERIA												
SUBDIVISION (COUNTY)	DEPTH TO GROUNDWATER	PERCOLATION RATES	SLOPE	TOTAL NUMBER OF LOTS	PRESENT DENSITY	WELLS	SEWAGE DISPOSAL SYSTEM	SUSCEPTIBILITY TO FLOODING	AGE OF SUBDIVISION	PROXIMITY TO SURFACE WATERS	RATIO OF GROUNDWATER FLOW TO EFFLUENT FLOW	DEVELOPMENT POTENTIAL	TOTALS
Park Garden Estates (Cascade)	5	0	0	3	7	3	1	5	3	6	5	0	38
Woodland Estates (Cascade)	5	5	0	10	5	8	1	3	1	6	10	5	59
Valley View (Deer Lodge)	5	0	0	10	10	8	1	0	5	6	15	5	65
Sunset (Deer Lodge)	5	0	3	3	5	8	1	0	3	6	10	10	54
Opportunity (Deer Lodge)	15	0	0	10	10	8	1	0	5	6	15	5	75
Lakeview (Granite)	10	0	0	10	2	3	1	3	1	4	5	10	49
Colorado Heights (Lewis & Clark)	5	5	5	0	5	8	1	0	3	4	10	5	51
Lambkins (Lewis & Clark)	10	5	0	10	10	8	1	0	5	2	10	5	66
Sewell's Addition #4 (Lewis & Clark)	10	5	0	10	10	8	1	0	3	6	15	10	78
South Libby Flats (Lincoln)	10	10	0	10	10	8	1	5	5	6	10	5	80
West Libby (Lincoln)	10	0	0	10	5	8	1	0	5	4	10	10	63
Yaak Meadows (Lincoln)	10	0	3	6	2	8	1	3	3	6	10	10	62
Seeley Lake Shoreline (Missoula)	10	0	0	10	5	3	1	0	5	6	10	10	60
Clark Addition (Missoula)	10	5	0	3	5	3	1	0	3	6	5	10	51
Eastbrook Addition (Missoula)	10	0	0	3	10	3	1	0	3	6	5	10	51
Mallard Estates (Missoula)	10	5	0	3	5	8	1	0	3	4	5	10	54
Five Acre Tracts (Park)	5	5	0	10	5	8	1	0	5	4	15	10	68
H & R Addition (Ravalli)	15	5	0	10	2	8	5	0	3	6	10	10	74
Bass Creek Development (Ravalli)	10	0	3	2	8	1	3	3	6	5	10	10	61

TABLE 3. Continued.

SUBDIVISION (COUNTY)	EVALUATION CRITERIA												
	DEPTH TO GROUNDWATER	PERCOLATION RATES	SLOPE	TOTAL NUMBER OF LOTS	PRESENT DENSITY	WELLS	SEWAGE DISPOSAL SYSTEM	SUSCEPTIBILITY TO FLOODING	AGE OF SUBDIVISION	PROXIMITY TO SURFACE WATERS	RATIO OF GROUNDWATER FLOW TO EFFLUENT FLOW	DEVELOPMENT POTENTIAL	TOTALS
Entropy Acres (Ravalli)	15	0	0	3	2	8	1	0	3	6	15	10	63
Hawker Lane Estates (Ravalli)	15	5	0	3	5	8	1	0	3	6	10	10	66
Bassard Development (Ravalli)	10	5	0	3	2	8	1	5	3	6	5	10	58
Florentine Acres (Ravalli)	10	0	0	10	2	8	1	5	3	6	10	10	65
Klements Road (Ravalli)	10	0	0	10	5	8	1	0	3	4	5	10	56
Burnt Fork Tracts (Ravalli)	10	5	0	3	5	8	1	0	3	6	5	10	56
Kootenai Creek Road (Ravalli)	10	5	0	10	2	8	1	0	3	2	10	10	61
Dayton Addition (Ravalli)	15	0	0	6	2	8	1	0	3	6	5	10	56
Rippling Woods (Ravalli)	10	0	0	3	2	8	1	0	3	4	5	10	46
Wild Wood Ranchettes (Ravalli)	15	0	0	3	2	8	3	5	3	6	5	10	60
Tie Chute Lane (Ravalli)	10	0	0	3	2	8	1	0	1	4	5	10	44
Rickett's Road (Ravalli)	10	0	0	10	5	8	3	0	3	4	10	10	63
Gibson's Lake Tracts (Teton)	10	0	3	6	5	8	1	0	3	6	10	10	62

TABLE 4. FINAL PRIORITIZATION OF SUBDIVISIONS FROM THE EVALUATION PROCEDURE.

SUBDIVISION	TOTAL POINTS
South Libby Flats	80
Sewell's Addition #4	78
Opportunity	75
H & R Addition	74
Five Acre Tracts	68
Lambkin's	66
Hawker Lane Estates	66
Florentine Acres	65
Valley View	65
Yaak Meadows	64
West Libby	63
Entropy Acres	63
Rickett's Road	63
Gibson Lake Tracts	62
Kootenai Creek Road	61
Bass Creek Development	61
Seeley Lake Shoreline	60
Wildwood Ranchettes	60
Woodland Estates	59
Bassard Development	58
Klement's Road	56
Burnt Fork Tracts	56
Dayton Addition	56
Mallard Estates	54
Sunset	54
Colorado Heights	51
Clark Addition	51
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Although there has been a study recently completed on subdivision development in this area, there are no recorded instances of well contamination or raw sewage problems. The presence of inadequate sewage treatment systems in combination with seasonal high groundwater, flooding, porous soils, and 2 streams help justify the recommendation of this area for further monitoring. The pleasant physical setting and the availability of land for further subdivision give this area a high potential for development.

2) Sewell's Addition #4

Forty-one acre Sewell's Addition #4 lies in the Helena Valley and was subdivided in June 1971 into 70 lots. Sixty-five of the lots have been developed and experience seasonal high groundwater at two to four feet from the surface. The subdivision utilizes both individually drilled wells and individual septic tanks and drainfields. Soil in the area is a porous sand and gravel. Silver Creek runs through the subdivision.

Though the Helena Valley is experiencing considerable development pressure, high groundwater and flooding have delayed further subdividing in the area of Sewell's Addition #4.

3) Opportunity

Located three miles east of Anaconda, Opportunity is one of Montana's older communities. The area had experienced considerable settlement by the turn of the century as a mining town.

Wells extend to the second water table at a depth of approximately forty feet. Cesspools or outhouses are utilized in over thirty percent of the six-hundred family units. Lot sizes are typically one-half acre in size. Groundwater in this area is very high, commonly occurring at a depth of six to twenty-four inches. Much of the area is flood irrigated, soils are quite porous, and two creeks and the Clark Fork River are nearby. There have been numerous cases of raw sewage surfacing and approximately seventy percent of the sewage treatment systems have experienced failure. About twenty percent of the wells sampled have shown fecal coliform contamination.

The EPA, State Water Quality Bureau and local health officers have given this area high priority in developing satisfactory water and sewage disposal systems, but no definite plans have been implemented. Although further development has been essentially halted, the area deserves further study because of its striking water quality problems.

4) H & R Addition

H & R Addition is located just southeast of Hamilton and contains approximately one hundred lots. Only about thirty percent of the lots have been developed, even though the area was subdivided in the mid 1960's.

Nearly seventy-five percent of the sewage disposal systems are cesspools. The primitive sewage disposal systems combined with extremely high groundwater, flood irrigation, coarse grained soils, and the proximity to Skalkaho Creek yield a subdivision worthy of further consideration.

The problems in H & R Addition are typical of other subdivisions in the Bitterroot Valley which is noted for its beauty and solitude. The amenities of the valley have and will probably continue to propagate development. Further study of the H & R Addition could prove valuable in preventing future water quality problems in the area.

5) Five Acre Tracts

Platted in the 1930's, Five Acre Tracts is located on some 580 acres just west of Livingston. The subdivision has 407 homes and trailers, most of which are on one-quarter to five acre parcels. Although originally platted in five acre parcels, further division has created many smaller parcels.

The basic potential problem is a result of flood irrigation. Much of the subdivision is criss-crossed with irrigation and drainage ditches. In spring and summer, ditches are filled with water from the Yellowstone River. Not only does this practice affect groundwater levels, but individual sewage disposal systems are inundated with water when land is flood irrigated. Also, the irrigation water probably collects contaminants from domestic livestock wastes. Approximately twenty percent of the wells tested for bacteriological quality have been found to be contaminated. Also, about twenty percent of the sewage systems have failed on an annual basis. Irrigation water from the drainage ditches is returned to the Yellowstone River.

RECOMMENDATIONS

The following recommendations are made:

1) Field investigation of the five areas recommended for further study should be initiated. Investigation should be conducted for at least two years to determine what effect the subdivisions have on water quality. Chemical and microbial contamination from sewage

treatment systems should be the prime considerations. Field investigation should include:

a) Continuing groundwater and surface water quality monitoring within the subdivisions to determine the affects of subsurface disposal on water quality;

b) Monitoring of groundwater levels, subsurface sewage disposal loadings, and drinking water quality within the subdivisions.

2) Present and Future state guidelines which pertain to subsurface sewage treatment systems should be implemented at the local level. Though this is being done in some areas, efforts should be continued in this direction to assure consistent review by local and state authorities.

APPENDIX A

SUBDIVISION INVENTORY FORMS

APPENDIX A

County Cascade
Subdivision Woodland Estates
Local E½ of NE¼ of Sec. 8, T.19N, R.3E; NE¼ of SE¼ of Sec. 8; W½ of NW¼ of Sec. 9; NW¼ of SW¼ of Sec. 9, T.19N, R.3E.

1. Soil, slope, and topography as it applies to groundwater and surface water quality.

2. Housing density (lot size).
96 lots - one to five acre - the average size is 2½ acres and there is a possibility of futher subdividing.

3. Number of family units.
67 of the lots are occupied. There are also garages and sheds.

4. Age of subdivision.
July 1973

5. Characteristics of water supply and sewage disposal system.
Individual sandpoint wells (14'-25') deepest is 35'. Sewage disposal system via septic tanks and drainfields.

6. Comments.
Area is not in a designated flood plain area, but it is a flood prone area. Percolation is less than five minutes per inch. There are no springs. There is the Missouri River and flood irrigation. About 10 percent well contamination. There is no determined raw sewage problem. Shallow alluvial aquifer provides water to individual wells. Possibility of pollution of wells from effluent. Nutrients eventually will enter the Missouri River.

County Cascade
Subdivision Park Garden Estate
Local n ½ of NW ¼ of Sec. 23 T.20N, R.3E

1. Soil, slope, and topography as it applies to groundwater and surface water quality.

2. Housing density (lot size).
Sixteen lots. All are one acre.

3. Number of family units.
Sixteen houses and a few garages, etc.

4. Age of subdivision.
1964.

5. Characteristics of water supply and sewage disposal system.
Community well (200 feet on lot number one -- they have a storage tank with well). There are a few evapo-transformation systems, but not all have septic tanks and drainfields. Individual sewage systems.

6. Comments.
Septic tanks bad on occasion. All of the subdivision is in a designated flood plain. Percolation is less than 50 minutes/inch as a rule. The test holes were as follows: Lot #2 - 15 minutes/inch; Lot #5 - 75 min/in.; Lot #7 - 80 min/in.; Lot #8 - 360 min/in; Lot #9 - 120 min/in; Lot #10 - 40 min/in; Lot #11 - 30 min/in; Lot #12 - 80 min/in; Lot #13 - 60 min/in; Lot #14 - 120 min/in. There is no irrigation, springs, or streams - flooding from Missouri (¼ mile away) and Sun River (1 mile away). Problem in spring with raw sewage on surface. Madison fan used for water supply. Very little chance of pollution of this deep aquifer. Nutrients from efflurnt may reach river; however, river has very high dilution capacity.

County Deer Lodge
Subdivision Valley View (West of Anaconda)
Local Sec. 21, T 6N, R 9W

1. Soil, slope, and topography as it applies to groundwater and surface water quality.

Gently sloping, dark colored deep loamy soils on terraces, shallow to deep loamy soils on outwash fans. [illegible]

2. Housing density (lot size).

236 lots. Nearly all are 100 x 150'.

3. Number of family units.

Nearly all are developed.

4. Age of subdivision.

April, 1957

5. Characteristics of water supply and sewage disposal system.

Individual drilled wells at about 40'. Individual sewage disposal systems. Septic tanks and drainfields are generally utilized.

6. Comments.

Problem here with very small lots and individual water and sewage disposal systems. Six irrigation ditches run north to south and 3 run east to west. There is raw sewage discharged in spots near the creek. Percolation rates range from 1 minute/inch to 13 minutes/inch. There is a fairly good chance the town may be getting a collective water and/or sewage system via a grant. Alluvium along Warm Springs Creek contains considerable groundwater. Large numbers of lots, small lot size and course soils could lead to pollution problems. Effluent will eventually enter Warm Springs Creek.

APPENDIX A

County Deer Lodge
Subdivision Sunset (East Side Georgetown Lake)
Local NW¼, Sec. 17, T.5N, R.13W

1. Soil, slope, and topography as it applies to groundwater and surface water quality.

   Top soil is silty clay loam to 2 feet, silty sand and fractured limestone fragments to about 10 feet. Most lots are at about an 8% slope, some much steeper (upwards of 30%).

2. Housing density (lot size).

   20,000 sq. ft. - 36 lots in all.

3. Number of family units.

   6 at present time.

4. Age of subdivision.

   about 1971.

5. Characteristics of water supply and sewage disposal system.

   Both water supply and sewage disposal is taken care of by individual systems. Wells are drilled at a depth of 120 to 300'. Sewage disposal is by septic tank and drainfields.

6. Comments.

   The limestone and slope create an immediate problem - the area is beautiful and bound for development. No evidence of raw sewage or well contamination. Percolation rates range from 2 to 14 minutes/inch with the average being about 6.5 minutes/inch. Groundwater is present in Precambrian bedrock. Fine-grained soils will provide filtration for bacteria if soil depth is sufficient. If soils are shallow sewage may infiltrate into bedrock and cause well contamination. Nutrients from effluent will move into Georgetown Lake.

County Deer Lodge
Subdivision Opportunity
Local

1. Soil, slope, and topography as it applies to groundwater and surface water quality.

Nearly level, poorly drained due to the presence of heavy clay. There are loamy soils 15 to 60 inches deep over sand and gravel. Groundwater is very high - 6" to 4' - most of the area is at about 2'.

2. Housing density (lot size).

Ranges from 10 acres in size to ½ acre - many 20,000 sq.-ft. lots.

3. Number of family units.

600 family units.

4. Age of subdivision.

1900's

5. Characteristics of water supply and sewage disposal system.

Water comes from individual wells - most are drilled, some are driven. They go to the 2nd water table which is at 40'. Individual sewage disposal systems - 60% have septic tanks and drainfields; 30% cesspools, (there are a few septic tanks and seepage pits); 5% outhouses. About 20% of wells are contaminated yearly. About 70% sewage system failure.

6. Comments.

The area has extremely high groundwater, the area if flood irrigated with water from the Clark Fork River. As one goes west to east, these problems get progressively worse. Raw sewage and well contamination are a major problem, with raw sewage readily seen on the surface and in irrigation ditches. Percolation rates range from 1 to 10 minutes/inch (most are between 5 and 10 minutes/inch). The high groundwater is due to a perched high water table due to the heavy clay. Aquifer is unconsolidated alluvium of Quaternary age. High groundwater table, individual wells, improper disposal systems will continue to create pollution problems.

County Granite
Subdivision Lakeview
Local SW¼. Sec. 24, T.5N, R.14W, M.P.M.

1. Soil, slope, and topography as it applies to groundwater and surface water quality.
Soil Profile Holes: A - 0-6" Topsoil; 6"-5' Light brown loam containing broken shale; 5'-6' Yellow clay loam and broken limestone; 6'- Solid and fractured limestone. B - 0-6" Topsoil; 6"-4½' Brown sandy loam contining broken shale; 4½'-6' Loam containing broken shale; 6'- Solid and fractured limestone. C - 0-6" Topsoil; 6"-4' Light brown loam containing broken shale; 4'- Solid and fractured limestone. The SCS classifies the soil as Wessel Series.

2. Housing density (lot size).
53 lots

3. Number of family units.
about 7 units.

4. Age of subdivision.
February 1974

5. Characteristics of water supply and sewage disposal system.
A common water supply is utilized, but sewage is handled individually by septic tanks and drainfields. There is a 3:1 ratio septic tanks to cesspools.

6. Comments.
The entire middle portion of the subdivision which comprises most of the lots is restricted from any building. This area is flood nearly every spring. These lots; however, have been about 70% sold; so what is happening is questionable. The local is beautiful and I would look for homes, etc., inspite of the flood problem. High groundwater and quick runoff problems. There is also a 5% systems failure. Percolation rate is 15 minutes/inch. Aquifer probably is Precambrian bedrock. Separation of upper alluvial materials may prevent pollution of deep groundwater system. Shallow alluvial system receives effluent and probably moves effluent to Georgetown Lake.

County Lewis & Clark
Subdivision Colorado Heights
Local W ½, NE¼, Sec. 12, T.9N, R.5W

1. Soil, slope, and topography as it applies to groundwater and surface water quality.
The soil on the subdivision has been classed by the SCS as Nuley sandy loam, very rocky, 4-35% slopes. 0-4" grey-brown sandy loam; 4-11" brown clay loam; 11-25" grey sandy loam; 25-41" yellow gravelly loam; 41-58" light grey sand; 58"-- coarse grained granitic rock. These soils have severe limitations for septic tank drainfields due to steep slopes, shallow depths to bedrock and rapid permeability.

2. Housing density (lot size).
29.81 acres - 9 lots - They very from 2.87 to 3.50 acres.

3. Number of family units.
12 homes (9 originally) -- about 3 have since been resubdivided.

4. Age of subdivision.
February 5, 1965

5. Characteristics of water supply and sewage disposal system.
Individual drilled wells. Depth of wells is about 40-80 feet. Individual septic tanks and drainfields are used for sewage disposal.

6. Comments.
Problem with steep slopes - very little area to drill and put in sewage systems. Percolation rate -- two minutes or less per inch. No indication of raw sewage or well contamination. This gulch has some area of elevated nitrate concentrations in wells, but the causes are not well understood and no waters in excess of public heatlh standards are present. Shallow soils, fractured bedrock are thought to be factors in allowing nitrate movement into wells. A dense development in the area will probably lead to contamination problems.

County Lewis & Clark
Subdivision Lambkins (Lincoln)
Local Sec. 24, T.13N, R.9W

1. Soil, slope, and topography as it applies to groundwater and surface water quality.

On the major area of these subdivisions, the SCS has classed the soils as Stryker silts loam. They have severe limitations for septic tank drainfields due to seasonal high water tables (4-6' annually) and gravelly below 4' with rapid permeability. Lesser areas are classed as Maxville silt loam and Swims silt loam. Gravel is encountered at approximately 2' and seasonal water table at 6' plus or minus.

2. Housing density (lot size).

191 lots - they range in size from 100 feet by 100 feet, 76 feet by 145 feet; 100 feet by 174 feet, etc.

3. Number of family units.

4. Age of subdivision.

April 21, 1955

5. Characteristics of water supply and sewage disposal system.

Individual water and sewage systems - most sewage systems are septic tanks and drainfields; some cesspools. There is high groundwater - 2-5 feet. Wells are mostly sandpoint, and go to a depth off from 15 to 25 feet.

6. Comments.

Problem with high groundwater and very porous soils. This along with many shallow wells. The percolation rate is very fast; some examples are as follows: Test hole #1 - disappeared immediately; Test hole #2 - is less than 2 minutes/inch. Aquifer is unconsolidated Quaternary alluvium along the Blackfoot River. Large subsurface water flow. Possibility of nutrient or bacterial contamination of wells. River will receive nutrient load.

APPENDIX A

County Lewis & Clark
Subdivision Sevell's #4
Local SE¼. Sec. 30, T.11 R.3W

1. Soil, slope, and topography as it applies to groundwater and surface water quality.

The soil on this subdivision has been tentatively classed as Fairdale Loam by the SCS. 0-10" loam, 10"-15" silt loam, 15"-35" grey sandy loam, 35"- loose sand and gravel. This soil has a severe limitation for septic tank drainfields because of flood hazard. High water table, rapid permeability and groundwater pollution hazard.

2. Housing density (lot size).

70 lots - 66 are 145' x 138', 4 are 145' x 165' - 41.40 acres in all.

3. Number of family units.

65 family units - mostly trailers - some homes

4. Age of subdivision.

June 8, 1971 - amended September 20, 1972

5. Characteristics of water supply and sewage disposal system.

Water - all individual shallow wells - many are sandpoint wells, some are drilled (casings range 2" to 6"). depth of wells - 35' to 40' - sewage - individual septic tank and drain fields

6. Comments.

Problem with high groundwater water, with high probability of groundwater pollution problems. Vegetation consisted of lawns and gardens - a few trees. Percolation - 3 minutes/inch. Aquifer is Quarternary Alluvium along Silver Creek. Possibility of well pollution from septic systems. Nutrients probably will enter Silver Bow Creek.

County Lincoln
Subdivision West Libby
Local

1. Soil, slope, and topography as it applies to groundwater and surface water quality.

This general soil is dominated by gently sloping to undulting shallow to moderately deep gravelly & cobbly loam, silt loam & fine sandy loam soils with light yellowish brown colored surfaces. These soils are underlain by very gravelly & cobbly loamy sand materials at 15 to 40 inch depths. Free calcium carbonates are usually absent in these soils except for a few very localized small areas. Minor inclusions of deep soils do occur intermingled on smooth slopes & on included glacial till. Elevation ranges from 1,800 to 2,300 feet. Mean annual precipitation is 18 to 25 inches. The frost free season is 90 to 105 days. These soils are used mainly for forest products although a few areas have been converted to dryland & irrigated hay & pasture.

2. Housing density (lot size). Most of the urbanization around Libby & Troy is on
20,000 sq.ft. ¼ to 3/4 acre (average is just under ½ acre) these soils.

3. Number of family units.
40 - 60 units - 1970 census = 750 people. 30 percent developed.

4. Age of subdivision.
1950's.

5. Characteristics of water supply and sewage disposal system.
There are both individual wells and parts of area are served by Libby public water supply. They have individual sewage disposal systems which are mostly septic tanks and drainfields. Wells go down 10 to 100 feet. If high ground and flood plain is excluded, area is about 50 percent developed.

6. Comments.
Although not in a flood plain, the very porous soil and high groundwater persists. Four subdivision are represented in this area. They are: Ski Dale, Glenwood Homes, Shatty Rest and Woodway Park. Percolation rate varies from less than seven minutes to five minutes/inch. Wells vary in depth from 20 to 40 feet. Occasional raw sewage problems, but not too much; however (probably due to high percolation). Alluvium and glacial outwash along the Kootenai River generally contains moderate to abundant groundwater. Those lots with water supply wells, shallow groundwater and coarse soils could develop pollution problems, as development proceeds. Effluent eventually will reach the Kootenai River.

County Lincoln
Subdivision Yaak Meadows
Local J.E.S. 402 T.36N, R.31W

1. Soil, slope, and topography as it applies to groundwater and surface water quality.

This general soil is dominated by gently sloping to undulating shallow to moderately deep gravelly and cobbly loam, silt loam and fine sandy loam soils with light yellowish brown colored surfaces. These soils are underlain by very gravelly and cobbly loamy sand materials at 15-40 inch depths. Free calcium carbonates are usually absent in these soils except for a few very localized small areas. Minor inclusions of deep soils do occur intermingled on smooth slopes & on included glacial till. Elevation ranges from 1,800 to 2,300 feet. Mean annual precipitation is 18 to 25 inches. The frost free season is 90 to 105 days. These soils are used mainly for forest products although a few areas have been converted to dryland & irrigated hay & pasture. Most of the urbanization around Libby and Troy is on these soils.

2. Housing density (lot size).

46 lots - ranging from 6 to 7.00 acres - most are about one acre parcels.

3. Number of family units.

one house.

4. Age of subdivision.

February 1971

5. Characteristics of water supply and sewage disposal system.

Individual water and sewage disposal systems are planned for the area. Septic tanks and drainfields. No percolation rates have been determined.

6. Comments.

The area is very marshy with high groundwater and susceptable to flooding from the Yaak River. The north side lots are on a steep slope. There will be problems finding places for a drainfield. The area being developed may be of a seasonal nature. The aquifer beneath this subdivision is alluvium and glacial debris along the Yaak River. Data from the site are insufficient to assess the potential for groundwater problems. Coarse soils and high groundwater; however, may lead to future problems.

County Lincoln
Subdivision South Libby Flats Area
Local

1. Soil, slope, and topography as it applies to groundwater and surface water quality.

   Forested Soils on Outwash Terraces. This general soil is dominated by gently sloping to undulating, shallow to moderately deep, gravelly and cobbly loam, silt loam and fine sandy loam soils with light yellowish brown colored surfaces. These soils are underlain by very gravelly and cobbly loamy sand materials at 15 to 40 inch depths. Free calcium carbonates are usually absent in these soils except for a few very localized small areas. Minor inclusions of deep soils do occur intermingled on smooth slopes and on included glacial till. Elevation ranges from 1,800 to 2,300 feet. Mean annual precipitation (over)

2. Housing density (lot size).

   About ¼ to ½ acre lots

3. Number of family units.

   Potential for development - 2,200 people -- there are 780 housing units scattered throughout.

4. Age of subdivision.

   1950's

5. Characteristics of water supply and sewage disposal system.

   Individual well water and sewage disposal system. Septic tank and drainfields are utilized for most systems. There are; however, cesspools and septic tanks and seepage pits. There are high number of inadequate systems. The groundwater is from four to seven feet. Wells depths 10 to 90 feet. They are drilled wells and yield 15 to 20 gallons per minute. For example, some have no septic tanks -- some are 50 gallon barrels with rocks inside, etc.

6. Comments.

   This area is in flood area -- designated flood plain with high groundwater. This area is actually five subdivisions - that is from the city as one goes south on both sides of highway. They are: 1) White Haven, 2) Vicks Tracts, 3) Pioneer, 4) Wards, 5) Granite.

   The aquifers are non-consolidated -- at average yield 15 to 20 gallons per minute. Alluvial fan exists throughout area. Percolation rate is less than one in areas to greater than three minutes per inch. Thirty percent of wells are containminated. There is no recorded raw sewage problem. The aquifer is alluvium and glacial outwash along the Kootenai River. Groundwater is relatively abundant. Shallow groundwater and coarse soils may create groundwater pollution problems. The size of this development and additional potential developments make this an important area. No problems of outwash containimation are presently known, but could be important in the future.

1. (Continued) is 18 to 25 inches. The frost free season is 90 to 105 days. These soils are used mainly for forest products although a few areas have been converted to dryland and irrigated hay and pasture. Most of the urbanization around Libby and Troy is on these soils.

County Missoula
Subdivision Clark Addition
Local Sec. 34 T 17N R 15W

1. Soil, slope, and topography as it applies to groundwater and surface water quality.

2. Housing density (lot size).
Twelve one acre lots -- all but five have not been built on -- they will be shortly.

3. Number of family units.
Seven family units.

4. Age of subdivision.
June 1962

5. Characteristics of water supply and sewage disposal system.
City water is used here, but all are utilizing individual septic tanks and drainfields. Percolation rate is less than five minutes per inch. No aquifer involved. No possible water supply pollution problem. Nutrients may eventually reach the lake, but Seeley is already a nutrient rich lake.

6. Comments.
Hemlocks Drive takes one to Clark Addition. The people are year around people and all lots will be occupied.

APPENDIX A

County Missoula
Subdivision Mallard Estates
Local W½, Sec. 5, T.13N, R.20W

1. Soil, slope, and topography as it applies to groundwater and surface water quality.

   Shallow to moderately deep, sandy and gravelly soils and somewhat poorly drained loamy soils on river flood plains.

2. Housing density (lot size).

   49.978 acres in all - 25 lots which range from 1.4 to 2.154 acres.

3. Number of family units.

   25 family units - homes and trailers.

4. Age of subdivision.

   July 1971

5. Characteristics of water supply and sewage disposal system.

   There are individual wells to a depth of 40 to 80 feet. Most wells are drilled; however, there are a few sand-point. Sewage is disposed of individually by septic tanks and tile drainfields.

6. Comments.

   This is a problem due not only to a high groundwater table of one to five feet, but also is prone to flood irrigation and is close to the Clark Fork River. Percolation rate is less than five minutes per inch. Part of water is recharge from the river - most is irrigation water. There is no evidence of well contamination or raw sewage. Water supply provided from alluvium along Clark Fork River. Depth to aquifer dilution by irrigation water, and probably moderate to large subsurface flows will reduce possible impacts of effluent. The River will; however, receive nutrients from this development.

County Missoula
Subdivision Eastbrook Addition
Local SW¼, Sec. 11, T.13N, R.19W

1. Soil, slope, and topography as it applies to groundwater and surface water quality.

2. Housing density (lot size).
20,000 square feet lots. 11 in all.

3. Number of family units.
11 homes

4. Age of subdivision.
September 1968

5. Characteristics of water supply and sewage disposal system.
Water is provided by Montana Power Inc. Sewage disposal is via individual septic tanks and drainfields.

6. Comments.
There is high groundwater at the four to five feet level. The groundwater and slope is in the direction and near in local of Rattlesnake Creek. Percolation rate is ten minutes/inch. Aquifer source is the Rattlesnake Creek channel and from runoff in the hills. Municipal water supply - no individual water supply systems are used in this subdivision. Nutrients will eventually enter Rattlesnake Creek. Groundwater in shallow alluvium along Rattlesnake Creek receives effluent.

APPENDIX A

County Missoula
Subdivision Seeley Lake Shoreline
Local Sec. 3, T.16N, R.15W

1. Soil, slope, and topography as it applies to groundwater and surface water quality.
   Deep, sandy, loamy and gravelly forested soils with some clay on to rolling glaciated valley plains which is presently the lake. Slope is only about 2% to lake.

2. Housing density (lot size).
   90 lots range from three to ten acres - average two to five acres.

3. Number of family units.
   sixty plus.

4. Age of subdivision.
   December 1944

5. Characteristics of water supply and sewage disposal system.
   A few of the older sites have cesspools. The others are septic tanks and drainfields. City water for most - some with some shallow hard dug wells - some people draw water from the lake.

6. Comments.
   There is high groundwater at two to three feet from surface - some sites are very close to lake in noncompliance with law. The place is both seasonal and year around residence and probably will be developed to the maximum due to the beautiful surroundings. This subdivision is on the west side of the lake off of C Street. Those residences with individual dug wells may have some contamination problems due to the shallow water table and use of cesspools. Large lot size and seasonal use will tend to reduce possible pollution problems. Effluent from the waste systems will ultimately enter Seeley Lake, which presently has a high nutrient load.

County Park
Subdivision Five Acre Tracts
Local Secs. 23-26, W½, T.2S, R.9E

1. Soil, slope, and topography as it applies to groundwater and surface water quality.

2. Housing density (lot size).
Originally five acre tracts now 59 are less than ½, some;however, are being subdivided.

3. Number of family units.
407 trailers and houses (126 of which are trailers). There are 236 lots, 580 acres, 31 are ½ to 1 acre in size; 141 are 1 to 5 acres and six are on greater than five acre lots.

4. Age of subdivision.
1930's

5. Characteristics of water supply and sewage disposal system.
Nearly all have individual wells and sewage disposal systems. 90 to 95 percent have septic tanks and drainfields. Wells go to a depth of 32 to 60 feet. Most of the area is flood irrigated. The groundwater would be about 10 to 20 feet but with flood irrigation, it is six. The fields are flooded by a wave of water. Sewage systems failure is high (about 20 percent per year). Estimated 20 percent well contamination.

6. Comments.
This is a large and developing area near Livingston. The flood irrigation is highly significant and a major problem. Groundwater pollution is inevitable. The water for irrigation flows from and to the Yellowstone River. The high groundwater comes and goes with the irrigation. The smaller tracts are being built upon and future development is virtually inevitable. Aquifer is unconsolodated Quaternary Alluvium along the Yellowstone River. Moderate to large groundwater flow. Continued groundwater pollution probable. Nutrients will enter Yellowstone River.

APPENDIX A

County Ravalli
Subdivision H & R Addition
Local

1. Soil, slope, and topography as it applies to groundwater and surface water quality.
A large portion of this subdivision is occupied by Corvallis silt loams slightly to moderately saline and Corvallis silt loam poorly drained. Loams and silt loams overlay sands and gravels at about 4 feet. These soils have severe limitations for septic tank drainfields due to flood hazard, seasonal high water table, and a groundwater pollution hazard & rapid permeability in the sands and gravels. Grantsdale loams and cobbly loams have developed on lesser areas. Loams and cobbly loams overlay sand & gravels at 20" to 36". These soils can have a seasonal high water table ranging

(continued - over)

2. Housing density (lot size).
Five acre tracts - a few are 1 to 5 acre, there are 100 lots total.

3. Number of family units.
About 30 homes less than 50 percent developed.

4. Age of subdivision.
about 1964.

5. Characteristics of water supply and sewage disposal system.
Individual water and sewage systems. There is one experimental evapo-transfermation system - 75 percent cesspools - septic tanks and seepage pits. Groundwater is found one half to three feet from surface. Wells are driven and drilled - 25 to 40 feet - percolation 20 to 80 minutes/inch.

6. Comments.
The groundwater level is so high that tires are placed in the road to keep the road from sinking. There is one house that send sewage to a ditch. There is flood irrigation and springs. Aquifer is alluvium along Skalkaho Creek. Fine-grained soils will inhibit movement of bacteria. Shallow wells, improperly constructed waste disposal systems and a shallow groundwater table are conditions condusive to groundwater pollution. Additional developments and future failures of disposal systems could cause groundwater pollution problems.

1. Continued.

from 1 to more than five feet. In areas of high seasonal water table, a groundwater pollution hazard exists ~~dur~~ due to rapid permeability of the sands and gravel. Hamilton silt loam has developed on small areas of the subdivision. Silt loams overlay gravelly loam at 40 to 60". These soils present slight limitations to the installation of septic tank drainfields.

County Ravalli
Subdivision Klements Road #9
Local

1. Soil, slope, and topography as it applies to groundwater and surface water quality.

The soils that have developed on the subdivision are imperfectly well drained to moderately well drained. They are loams or gravelly loams over gravel at 1 to 4 feet. The area is partially in the floodplain and seasonal high water table is near the surface. This and a groundwater pollution hazard present severe limitations for the installation of septic tank drainfields. Rapid permeability in the gravels.

2. Housing density (lot size).

5 (the majority) to 10 acre lots - about 100 all together.

3. Number of family units.

15 to 20 family units.

4. Age of subdivision.

1970 by deed and Certificate of Survey.

5. Characteristics of water supply and sewage disposal system.

The wells and sewage disposal are individual systems. Sewage is disposed via cesspools (about 30%) and seepage pits. 70% septic tanks and drainfields. Wells are drilled or driven at 40'.

6. Comments.

There is groundwater at 3 to 5 feet from surface. Percolation rate is 5 to 20 minutes/inch. No known raw sewage or well contaminati A lot of springs in the area, and a slough. Aquifer is alluvium in the Bitterroot Valley. Vertical separation of water intake portion of wells and drainfields and lot spacing helps prevent pollution problems. Effluent flows through groundwater system to Bitterroot River and its tributaries.

County Ravalli
Subdivision Hawker Lane Estates
Local 5½ SE ¼ Sec. 6 T.6N R. 20W

1. Soil, slope, and topography as it applies to groundwater and surface water quality.

The soils that have developed on the area platted into lots are as follows: Ce - Chamokane loamy sand-sandy loam shallow. Cc - Chamokane gravelly loamy sand, shallow. Sze - Slocum complex, shallow, slightly saline. Szg - Slocum loam. Series descriptions can be found in the Bitterroot Vally SCS Soil Survey Manual. These soils have shallow depth to sand and gravel, very rapid permeability below two (2) feet (approximately), high seasonal water table (1 to 3 feet), and low moisture holding capacity. These soils are rated severe for septic tank drainfields due to occasional flood hazard, seasonal high water table and groundwater pollution hazard. The Slocum shallow muck complex has developed over the park area.

2. Housing density (lot size).

31.971 acres total, 26 lots - lots range from 1 to 1.8 acres -- these; however, are long lots with the houses in front.

3. Number of family units.

There are ten trailers on subdivision

4. Age of subdivision.

1971 platted - 1972 developed.

5. Characteristics of water supply and sewage disposal system.

There are individual water and sewage disposal. Raised drainfields are used on an experimental basis for five lots - the others have individual septic tanks and drainfields. Wells are individual drilled wells 30 to 40 feet.

6. Comments.

This is a major problem subdivision. A creek (Gird Creek) runs through the tracts, there are springs and the areas irrigated and groundwater is 1½ to 4 feet. Most of area is 1½ feet level. The E. S. 91 form sent to state says the minimum groundwater at seven feet. Percolation rates one to five minutes per inch. There is irrigation, springs and creek. No noted raw sewage or well contamination. Aquifer is alluvium along Gird Creek and the Bitterroot River. Estimated moderate flow of groundwater. Shallow water table and individual sewage disposal and wells may lead to pollution problems. Gird Creek receives subsurface flow of effluent.

County Ravalli
Subdivision Florentine Acres #6
Local

1. Soil, slope, and topography as it applies to groundwater and surface water quality.
The soils that have developed on Florentine Acres are imperfectly well drained to moderately well drained. They are loams or gravelly loams over gravel at 1 to 4 feet. The area is partially in the floodplain and seasonal high water table is near the surface. This and a groundwater pollution hazard present severe limitations for the installation of septic tank drainfields. Rapid permeability in the gravels.

2. Housing density (lot size).
approximately 800 acres in all, lots are 5, 10 & 20 acre tracts. The average is 10 acres.

3. Number of family units.
10 homes

4. Age of subdivision.
1968-69.

5. Characteristics of water supply and sewage disposal system.
Individual water supply systems and sewage disposal systems. Septic tanks and drainfields are utilized. There are some experimental raised drainfields. Wells are about 40' (drilled).

6. Comments.
The area is in groundwater at 3 to 5'. Much of it (about 2/3 of it) is located directly in the designated 100 year flood plain. Percolation rate is 10 to 30 minutes/inch. No problem with contamination or raw sewage. Aquifer is alluvium along the Bitterroot River. As area developes with individual sewer and water systems, water pollution problems may occur. Bitterroot River will receive nutrients from subsurface movement of effluent.

County Ravalli
Subdivision Bassard Development
Local

1. Soil, slope, and topography as it applies to groundwater and surface water quality.

The soils that have developed on Bassard Development are imperfectly well drained to moderately well drained. They are loams or gravelly loams over gravel at 1 to 4 feet. The area is partially in the floodplain and seasonal high water table is near the surface. This and a groundwater pollution hazard present severe limitations for the installation of septic tank drainfields. Rapid permeability in the gravels.

2. Housing density (lot size).

5 - 10 acre lots (about 30).

3. Number of family units.

50% developed.

4. Age of subdivision.

Certificate of survey 1970.

5. Characteristics of water supply and sewage disposal system.

Individual water and sewage disposal systems. Wells are drilled or driven (a sand point well). Wells' depth ranges from 25 to 40 feet. Majority use septic tanks and drainfields. Percolation rate at 1 to 10 minutes/inch - average is about 5 minutes/inch.

6. Comments.

A majority of this subdivision is in designated flood plain. There is also a high groundwater problem. (2 to 3 feet to groundwater). Six or seven lots are not in flood plain. No raw sewage or contaminated wells. Aquifer is alluvium along the Bitterroot River. High groundwater table, rapid infiltration rates could create local well pollution problems. Large lot size and considerable groundwater in the extensive aquifer along the Bitterroot River tend to limit pollution problems. Effluent from the subdivision will ultimately enter the Bitterroot River.

County Ravalli
Subdivision Tie Chute Lane #17
Local

1. Soil, slope, and topography as it applies to groundwater and surface water quality.

2. Housing density (lot size).
10 to 20 acre (some resubdivded by occassional sales) tracts - 15 lots

3. Number of family units.
3 houses

4. Age of subdivision.
1974 - Certificate of Survey

5. Characteristics of water supply and sewage disposal system.
Systems development is mostly septic tanks and drainfield. Drilled wells are 60;. Percolation rate is 5 to 10 minutes/inch.

6. Comments.
Groundwater is at the 1 to 3 foot level (some near 6-8') - generally 3 feet or so. The area has irrigation (from Tie Chute Creek). No contamination or raw sewage. Aquifer source if Tie Chute Creek. Geology, hydrology poorly known. Large lot size, moderately deep wells and small subdivision size will inhibit pollution development. Probably moderate to large amounts of groundwater in the area.

County Ravalli
Subdivision Rippling Woods Suburban Tracts #13
Local

1. Soil, slope, and topography as it applies to groundwater and surface water quality.

Soils on this site are coarse sandy loams, stony coarse sandy loams, and clay loams over gravel at 14 to 20". High groundwater (2-6') and rapid permeability of the gravels present a groundwater pollution hazard.

2. Housing density (lot size).

230 acres - 10 acre tracts. 23 lots in all.

3. Number of family units.

3 houses.

4. Age of subdivision.

1970-72.

5. Characteristics of water supply and sewage disposal system.

Individual wells and sewage disposal systems. Experimental systems which consist of raised drainfield at 1 house, rest are regular septic tanks and drainfields. Wells are drilled at 40'.

6. Comments.

The are looks very dry. There is a lot of Ponderosa Bull Pine and little undergrowth yet very high groundwater. The area is pretty, located near Hamilton and will be developed I am sure. The groundwater is accounted for by springs and irrigation which is found above the subdivision. Percolation is at 5 to 10 minutes/inch. No problems at this time with raw sewage and well contaminations. The aquifer, Big Creek, is hyrterrace deposits along the Bitterroot River. The high groundwater table and porous soils could lead to pollution problems. The lots are large; however, and there probably is a moderate flow of groundwater in the aquifer which will reduce pollution possibilities.

APPENDIX A

County Ravalli
Subdivision Ricketts Road #12
Local

1. Soil, slope, and topography as it applies to groundwater and surface water quality.

   Soils on this site range from gravelly sandy loam, cobbly loam and clay loam over gravels at 16 to 24". High groundwater in much of the subdivision and very rapid permeability in the gravels present a groundwater pollution hazard.

2. Housing density (lot size).

   Lots range from ½ to 20 acres - about 100 lots.

3. Number of family units.

   about 50 homes.

4. Age of subdivision.

   divided by deed and C. of Survey.

5. Characteristics of water supply and sewage disposal system.

   This subdivision has individual wells and sewage systems. They utilize mostly cesspools and sewage pits - about 60% - the rest are septic tanks and drainfields. Wells are drilled and/or driven - 25 to 40'.

6. Comments.

   This is located just above Hamilton and is prime for development. It is an old subdivision with pressure for development. The groundwater is very high, from 1 to 4' level. Percolation is 10 to 50 minutes/inch. (heavy soils). Aquifer - Blodgett Creek. Raw sewage from backup cesspools in irrigation ditches. There are a lot of irrigation ditches (major source of high groundwater). Groundwater is present in terrace deposits along the Bitterroot River. If densely developed, shallow groundwater and fine-grained soils and large lot size will help prevent possible pollution.

County Ravalli
Subdivision Burnt Fork Tracts #3
Local

1. Soil, slope, and topography as it applies to groundwater and surface water quality.
The dominant soils that have developed on the area known as Burnt Fork Tracts are as follows: Grantdale - loam or cobbly loam over gravel at 20-36". Severe limitations for septic tank drainfields - seasonal high water table 2-5', rapid permeability in gravels and groundwater pollution hazard. Gallatin - silt loam and silty clay loams over gravel at 24-36". Severe limitations for septic tank drainfields - seasonal high water table 1-2', rapid permeability in the gravels, groundwater pollution hazard and flood hazard. Corvallis - silt loam over gravel 48-60", rest is the same as Gallatin.

2. Housing density (lot size).
2, 5 & 20 acre tracts - 200 to 300 acres in all (assume 250 acres) - about 15 lots. (the majority are 5 & 20 acre tracts)

3. Number of family units.
15 homes and trailers - developed by deed. 4 homes and 11 trailers (the trailers are bunched together in 5 acre tracts)

4. Age of subdivision.
about 1962

5. Characteristics of water supply and sewage disposal system.
All water and sewage systems are individual. I believe septic tanks and drainfields predominate, but some cesspools are present in the area. There are septic tanks and seepage pits. There is a 3 to 5' groundwater table. Wells are 25 to 60' (40" avereage). Percolation rates 5-20 minutes/inch.

6. Comments.
The area is only partially developed at this time. There is considerable development pressure. The groundwater and sewage system plus the local yields a problem. The area if flood irrigated to boot. There is Burnt Fork Creek and a fairly large spring in the area. There is a problem in the trailer court with back up of sewage. The aquifer is alluvium along North Burnt Fork Creek. Vertical separation of water supply and drainfields and lot spacing helps prevent pollution problems. Additional developments will add effluent to the groundwater system which could possibly create some localized pollution problems.

APPENDIX A

County Ravalli
Subdivision Wild Wood Park Ranchettes #20
Local

1. Soil, slope, and topography as it applies to groundwater and surface water quality.
   Soils on this site are sandy loam and gravelly sandy loam over gravel at 20 to 24". These soils present severe limitations to the installation of septic tank drainfields due to flood hazard (90% in flood plain), high seasonal groundwater (1-3'), very rapid permeability in the gravels all which creates groundwater pollution hazard.

2. Housing density (lot size).
   5 - 10 acre tracts - 20 lots

3. Number of family units.
   12 to 14

4. Age of subdivision.
   1968 - C. of survey

5. Characteristics of water supply and sewage disposal system.
   Septic tanks and drainfields are more in evidence than other septic tanks seepage and cesspools. Percolation is at 5 to 15 minutes/inch. Wells are from 25 to 40'.

6. Comments.
   This subdivision is in the flood plain - it has high groundwater - 1 to 3". Areas in designated flood plain (90% in this flood plain) have irrigation ditches and springs. Problems with septic system failure, but no reported contamination or raw sewage. The aquifer is the Bitterroot River. Water supply is derived from unconsolidated alluvium in the flood plain of the Bitterroot River. Shallow groundwater and shallow wells could lead to problems & local groundwater contamination. The large lot size and moderate to large groundwater flow, may tend to prevent serious pollution problems.

County Ravalli
Subdivision Entropy Acres
Local

1. Soil, slope, and topography as it applies to groundwater and surface water quality.

   The soils that have developed on the area platted into lots are as follows: Czn - Grantsdale loam, level; Dc - Dominic loamy sand, level. Series descriptions can be found in the Bitterroot Valley SCS Soil Survey Manual. The Grantsdale loam has 20 to 36 inches of friable loam over sand and gravel, very rapid permeability and low moisture holding capacity in the sand and gravel and a seasonal high water table of from 2 to more than 5 feet. The small area of Dominic loamy sand has 12 to 20 inches of sandy loam over

   (continued-over)

2. Housing density (lot size).

   15 lots - ½ acre (20,000 square feet)

3. Number of family units.

   2 homes and one church and a storage shed.

4. Age of subdivision.

   1971

5. Characteristics of water supply and sewage disposal system.

   This was recorded illegally. This subdivision should never have been approved for residential property. Groundwater is at one inch and individual systems are being used for the two homes (individual wells, septic tanks and drainfields. The church has an evapo-transpiration system). Groundwater one foot to four feet. Wells are individual drilled wells at 40 feet.

6. Comments.

   This should be without any homes what-so-ever. The experimental system may or may not work. I do not know if it's even being used yet. Percolation rates are five to ten minutes/inch (estimate). Irrigation ditches run through area. Spring (two) also run through the area. Groundwater is present in alluvium along Skalkaho Creek. High water take makes proper operation of waste disposal systems impracticle. Additional development of small lots will surely lead to future groundwater pollution problems. Effluent will ultimately reach Skalkaho Creek in the groundwater system.

1. Continued

loose sand and gravel, very rapid permeability and a seasonal high water table below five feet. The probability of groundwater pollution should be considered when proposing septic tanks and drainfields.

County Ravalli
Subdivision Dayton Addition
Local

1. Soil, slope, and topography as it applies to groundwater and surface water quality.

There is loam and gravelly loam at 1 to 3 feet. There is a sandy clay in much of the area interdispursed throughout the loam. The slope is 1 to 2%.

2. Housing density (lot size).

40 lots total - 5 acres each

3. Number of family units.

12 homes

4. Age of subdivision.

Certificate of survey 1968

5. Characteristics of water supply and sewage disposal system.

Individual drilled wells at 25 feet. The sewage disposal systems are individual utilizing mostly septic tanks and drainfields, some have septic tanks and seepage pits.

6. Comments.

Groundwater is from 1 to 3 feet from surface. Percolation rates are 5 to 30 minutes/inch. There is some minor flooding near irrigation ditches, but there is no reported well contamination. Development in Alluvium along the Bitterroot River. Large lot size and large groundwater flow will inhibit pollution of the aquifer.

County Ravalli
Subdivision Kootenai Creek Road #10
Local

1. Soil, slope, and topography as it applies to groundwater and surface water quality.
   Well graded sand and gravel.

2. Housing density (lot size).
   5 to 10 acre tracts - 1,000 acres

3. Number of family units.
   about 30.

4. Age of subdivision.
   Certificate of survey and deed - 1964 and 1973 (over a period). This is a series of subdivisions.

5. Characteristics of water supply and sewage disposal system.
   Individual systems. Septic tanks and drainfields - 50% and septic tanks and seepage pits - 50%. Wells are drilled and driven at depth of 25 to 40 feet (average is 30').

6. Comments.
   Groundwater at 2' to 5'. It is interesting that there are Ponderosa Bull Pine thickets, yet groundwater is 2 feet. Percolation rate is 2 to 10 minutes/inch. (some clay in area). Irrigation ditches throughout area, some spirng. Aquifer source if the Kootenai Creek. No raw sewage or well contamination known. Aquifer material, geological setting and groundwater system poorly known. High groundwater and coarse soils could lead to some pollution problems. Large lot spacing and possible moderate to large groundwater flows will inhibit groundwater pollution problems.

County Ravalli
Subdivision Bass Creek Development
Local

1. Soil, slope, and topography as it applies to groundwater and surface water quality.

A large portion of the subdivision are occupied by the St. Joe series. These are shallow, wet meadow soils of the low fans and terraces. Loam or gravelly loam has developed over sand and gravel at less than 20". High water table, flood hazard and potential groundwater pollution present severe limitations to the installation of septic tank drainfields.

2. Housing density (lot size).

13 lots total - 5 acre tracts

3. Number of family units.

4 homes

4. Age of subdivision.

It's under certificate of survey - about 1973 or 72.

5. Characteristics of water supply and sewage disposal system.

Individual water and sewage systems - septic tanks and drainfields. drilled wells at 25 to 40'. There is extensive irrigation. There are springs and sloughs in the area.

6. Comments.

High groundwater (3' to 5'). The area is rapidly being developed. Majority of water at 3 feet. It is a flood prone area from Bass Creek. No evidence of well contamination or raw sewage. Aquifer is alluvium along Bass Creek. Characteristics of the subsurface strata are poorly known but coarse-grained soils are known to be present. The small size of this subdivision and wide lot spacing will reduce pollution problems. High groundwater and coarse alluvium could allow substantial movement of bacteria.

APPENDIX A

County Teton
Subdivision Gibson Lake (East & West Tracts)
Local

1. Soil, slope, and topography as it applies to groundwater and surface water quality.
   The area comprising Gibson Lake Tracts has never been surveyed to determine the soils that have developed on the site. Ten-foot holes were dug on the following lots: On the west lots - 3, 7, 11, 16, 24A, 26, 31A, and 34. On the East lots - 1, 15 and 18. Information submitted indicated that the top eight to 24 inches to be a dark loam. From this depth to ten feet, the profile consisted of a gravelly light clay loam.

2. Housing density (lot size).
   50 lots - ½ to 1 acre in size.

3. Number of family units.
   17 family units are presently in - 37 have been sold.

4. Age of subdivision.
   January 1974.

5. Characteristics of water supply and sewage disposal system.
   All lots have individual wells and sewage systems (septic tanks and drainfields). They talk of putting in a collective system, but nothing will probably come of it. Well water is found from 8 to 40 feet. Groundwater ranges from 3 to 6 feet and from 10 to 16 feet. The wells are dug wells 8 to 40 feet.

6. Comments.
   Some lots have high groundwater, others are 10 to 16 feet. Slope is a problem - also the area is prime for development. This area could be a major problem area. Slope, rock outcropping; high groundwater, springs, present problems. The popularity of the place makes it a primary area of development. Most of the residents are seasonal at this time. I look for maximum development. The high groundwater is due to a perched water table. Percolation rates range from 7 to 30 minutes/inch with a vast majority at 1t minutes/inch. Groundwater and aquifer system not defined. Complex geological relationships in this area. Small lot size; high groundwater table and possible course materials could create problems. Gibson Lake will receive nutrients.

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